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STANDARD OPERATING PROCEDURE NO. 6

VIBRACORING AND PIEZOCONE VESSEL POSITIONING

Passaic River Study Area

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3.0
INTRODUCTION

The purpose of this document is to define the standard operating procedure (SOP) for positioning of the vibracoring and piezocone sampling vessels. Positioning procedures for vessels associated with bathymetric surveying are discussed in SOP No. 3, Bathymetric Surveying. The positioning requirements for the Acoustic Doppler Current Profiler (ADCP) are discussed in SOP No. 10, River Velocity Measurement Using Acoustic Doppler Current Profiler. Positioning requirements for suspended sediment sampling and bed load transport sampling are discussed in SOP No. 11, Collection of Bed Load and Suspended Load samples. The purpose of this procedure is to describe the positioning equipment and procedures to locate the survey vessels with sufficient accuracy and precision to meet project objectives during vibracoring and piezocone activities.

This SOP describes the needed equipment, field procedures, materials, and documentation procedures necessary to position survey vessels.

This procedure is to be followed, and any substantive modification to the procedure shall be approved in advance by the Contractor Project Manager (CPM), Facility Coordinator, and EPA Project Manager, including movement of sampling locations outside of the acceptable range of error for core sample location (defined as Acceptable Location Variance in Forms A1 through A4 SOP No. 8, Core Sample Processing) due to reasons such as inability to receive adequate Global Positioning System (GPS) coverage.

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Other SOPs will be utilized with this procedure, including:

- SOP No. 8 - Core Sample Processing
- SOP No. 13 - River Stage Measurements and Tidal Correction

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4.0
RESPONSIBILITIES AND QUALIFICATIONS

The CPM is responsible for assigning Project Staff to be responsible for the vibracoring and piezocone survey vessel positioning. The CPM is also responsible for assuring that this and any other appropriate procedures are followed by Project Staff.

The Project Staff assigned to survey vessel positioning are responsible for completing their tasks according to this and other appropriate procedures. Project Staff are responsible for reporting deviations from the procedure or nonconformance to the CPM, Site Manager, or Quality Assurance/Quality Control (QA/QC) Officer.

Only qualified personnel shall be allowed to perform this procedure. Qualifications will be based on previous experience or on-the-job training and supervision by another qualified person.

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5.0 PROCEDURE

5.1 EQUIPMENT LIST

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Since multiple procedures may be contained in this SOP, not all of which are necessarily conducted when using this SOP, not all materials on the Equipment List may be required for a specific activity.

The following items are necessary to position sampling vessels according to this SOP:

- 2x GPS Receivers
- 2x GPS External Antennas
- Communication link (i.e., 25 watt marine VHF Radios)
- Field logbook
- Coordinates of sampling locations

5.2 POSITIONING VESSELS

GPS will be used to locate vibracoring and piezocone vessels during implementation of activities specified in the FSP. GPS is a satellite-based positioning system that can be extremely accurate and precise. Two GPS units will be required: one on-board the sampling vessel with the receiving antenna to be approximately aligned with the deployment of the vibracore or piezocone, such as on the A-frame, and the other at a known fixed location (basestation) such as at the 80/120 Lister Avenue properties to test for location "drift."

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It should be emphasized that this SOP is for general guidance. Personnel performing positioning activities should follow the appropriate sections of the equipment user's manual, and have the manual available for reference at all times. The following background information and procedural steps are used in positioning.

1. For each of the planned vibracore or piezocone locations for the day, obtain the Vibracore Form Data Package (Forms A1 through A5, which are described and included with SOP No. 8, Core Sample Processing) for the vibracoring, or equivalent forms for the piezocone.

2. Sample locations will be selected prior to commencement of the survey, as described in the FSP and as shown on Forms A1 and A2 for the vibracoring or equivalent forms for the piezocone. The location of each selected sample location will be established as a latitude and longitude (lat/long) coordinate.

3. The latitude/longitude coordinates for the coring location for that day will be entered into the GPS unit to be in operation on board the survey vessel as way points. The base GPS unit will be calibrated against the primary trigonometric station, and both units checked to verify that locations given by the GPS are the same.

4. Actual sample locations are identified by using data provided by the GPS unit in the navigation mode[a]. On reaching the sample location, the coring or piezocone position is marked by dropping a buoy. The simplest means

[a] The navigation mode provides information on headings, distance remaining and time remaining. This information is based on the waypoint location and the present location of the vessel.

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of reaching an actual sampling location is to head along either a line of latitude or longitude, and on the instruction of the GPS operator, drop a buoy at the required latitude/longitude intersection. In accordance with SOP No. 4, paragraphs 3 and 4, Sediment Sampling over Water using Vibracore, the vibracoring vessel then anchors adjacent to the buoy. Similar positioning procedures will be followed by the piezocone vessel.

5. Once on location, actual latitude/longitude coordinates are recorded from the GPS unit on Form A2, line 3d and the latitude/longitude coordinates are checked to verify that vessel is within the Acceptable Location Variance in relation to the planned position (Form A2, lines 3b and 3a respectively). If not, adjust vessel location and recheck position. This process will be repeated until vessel position is acceptable.

6. The most accurate positions are established by computing the base station differential. This procedure requires that both GPS units be logged onto the same satellites. An average latitude/longitude position can then be obtained by taking 30 consecutive updates at synchronous times for both units (about 1 minute total time). The average latitude/longitude for the base station is then compared to its known coordinates, and the amount of drift (or differential) is computed. The differentials, displayed as delta units, are then relayed from the base station to the sampling vessel. These are entered into the sampling vessel GPS unit, and the corrected lat/long coordinates, taking into account this known real-time shift, are computed automatically by the GPS unit. The differential GPS coordinates are compared to the Acceptable Location Variation. If acceptable, these corrected (or post-differential) coordinates are recorded in lat/long on Form A2, line 3e as the post-differential, position for the vibracoring, or

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equivalent piezocone location. If the position is unacceptable, the vessel position is adjusted and the position rechecked. Record the Vibracore or Piezocone number. The Vibracore Number (which is equal to the Vibracore Location Number with the suffix "A" for the first coring at a given location, "B" for the second coring at the same location, etc.) will be recorded on Form A1; Form A2, Item 1; Form A3, Item a; and Form A4.

7. Once on location, collect samples in accordance with the appropriate SOP (SOP No. 4, Sediment Sampling Over Water Using Vibracore, SOP No. 12 -Cone Penetration Testing.

8. At the end of the sampling day, the data loaded in the GPS units are checked to verify the existence of all locations in which data were collected. Sampling locations will be plotted onto a master chart as the samples are collected and checked with the GPS data as a further verification that the correct locations and sampling schedule are being followed, and as a visual reference of the progress of the survey.

Note that, despite virtual worldwide 24-hour coverage, technical difficulties with GPS satellites can still occur. The field sampler will, therefore, monitor the GPS computer bulletin board (703-313-5910) or other GPS Information Source to stay apprised of satellite status. If in the event of system-wide or other long-term problems with GPS (e.g., satellite failures, etc.), positioning will be achieved using land-based methods. If a land-based method is selected, an SOP will be developed for its use.

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5.3 CALIBRATION, MAINTENANCE, AND USE OF FIELD INSTRUMENTS

GPS units will be calibrated in accordance with appropriate sections of the equipment user's manual, and as described in Section 5.2 of this SOP. Maintenance and use of GPS units should follow the appropriate sections of the equipment user's manual. Field personnel will have the manual available for reference at all times.

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6.0
QUALITY ASSURANCE REQUIREMENTS AND DOCUMENTATION

Quality assurance (QA) activities for positioning systems include weekly verification, by the QA/QC officer or his designee, that (1) data verification has occurred by charting single locations on the base map and comparison with the planned locations, and (2) that data appear appropriate. Inspection of field logbooks for appropriateness will be performed with each weekly verification.

Detailed positioning data will be recorded onto Forms A1 through A5 for the vibracoring and the equivalent Cone Penetration Testing Forms, as described. A field log will be maintained on board the survey vessel to record a summary of the vessel activities. The verification of the positioning data conducted at the end of the day will be recorded in a field log book maintained at the on-shore base.

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STANDARD OPERATING PROCEDURE NO. 7

MANAGEMENT AND DISPOSAL OF RESIDUALS

Passaic River Study Area

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3.0
PURPOSE AND SCOPE

The purpose of this document is to define the standard operating procedure (SOP) for disposal of sediment, water, personnel protective equipment (PPE), and other disposable materials generated during the RI at the Passaic River Study Area (the Site) that have come in contact with potentially contaminated materials.

This procedure describes equipment, field procedures, disposal containers, and documentation procedures necessary to dispose of waste sediment, water, PPE and other materials generated during activities at the Site. It also covers the handling of these materials up to the time they are disposed at an appropriate location.

This procedure is to be followed, and any substantive modification to the procedure shall be approved in advance by the CPM, Facility Coordinator, and EPA Project Manager.

Other SOPs will be utilized with this procedure, including:

- SOP No. 2 - Decontamination
- SOP No. 4 - Sediment Sampling Over Water Using Vibracore
- SOP No. 8 - Core Sample Processing

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4.0
RESPONSIBILITIES AND QUALIFICATIONS

The project manager or task leader is responsible for assigning Project Staff to coordinate disposal of materials at the Site. The task leader is also responsible for assuring that this and other appropriate procedures are followed by Project Staff.

The Project Staff assigned to dispose of sediment, water, PPE, and other materials are responsible for completing their tasks according to this and other appropriate procedures. Project Staff are responsible for reporting deviations from the procedure to the CPM, Site Manager, or Quality Assurance/Quality Control (QA/QC) Officer.

Only qualified personnel shall be allowed to perform this procedure. Qualifications are based on previous experience, or on-the-job training and supervision by another qualified person.

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5.0
RESIDUALS MANAGEMENT AND DISPOSAL PROCEDURES

Potentially contaminated sediment cuttings, water, and PPE will be classified into two categories: (1) solid materials consisting of sediments, sediment samples returned from the laboratory, damaged core tubes, used polybutyrate and aluminum liners, used PPE, and other materials used in the handling, processing and storage of sediment (addressed in Section 5.2); and (2) liquid wastes such as waste water and aqueous samples (addressed in Section 5.3). Sediment from cores collected during the vibracore activity (SOP No. 4) that is not processed for chemical analysis or geotechnical testing (SOP No. 8) may be either archived or disposed and will be segregated and handled separately according to their classification. To the extent practical, liquids generated during vibracoring and core processing should be separated from the solid material and each should be handled as described in this procedure.

5.1 EQUIPMENT LIST

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Since multiple procedures may be contained in the SOP, not all materials on the Equipment List may be required for a specific activity.

- 55-gallon open top drums (Department of Transportation [DOT] approved)
- 30-gallon (minimum) garbage bags
- Permanent marking pens and/or paint pens
- Duct tape
- Storage racks

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- Smaller (cooler size) storage containers
- Large self-contained core storage facility
- Large self-contained drum storage facility
- Waterproof logbooks
- Waterproof pens
- Appropriate health and safety equipment

5.2 SOLID MATERIALS

5.2.1 Solid Residuals Anticipated to be Archived

Three types of sediment residuals destined to be archived will be generated during the investigation: (1) sediment from cores that have either unacceptable recoveries or are unusable for other reasons; (2) sediment from processed cores outside of designated sampling intervals; and (3) excess sediment (homogenate) from designated sampling intervals generated during core processing.

On completion of sample processing, according to procedures outlined in SOP No. 8, the core liner will be cut to match the core section (i.e., to eliminate any air space) and to a maximum of five feet in length. Similarly, cores that were not processed will be measured, and the core liner cut to match the core section. The remaining liner will be capped with plastic end caps and taped securely with duct tape. The core liner will then be labelled using a permanent marker with the core number, core interval, date, and other pertinent information. The core liner will be placed in a storage rack, and secured in a temporary core storage facility.

During processing of the cores, excess homogenated sediment (i.e., material not sent to the laboratory from a particular sample interval) will be placed into a sample container

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or bottle and labelled with the core number, sample interval, date and any other pertinent information. The bottle will be placed inside a small (cooler size) container, and secured in a temporary core storage facility.

5.2.2 Solid Residuals Anticipated to be Disposed

Solid residuals destined for disposal generated during the investigation consists primarily of non-sediment solid materials generated during the collection and processing of cores, including items such as damaged stainless steel or aluminum core tubes, used polybutyrate core liners, aluminum foil from clean core liners and tubes, plastic sleeve storage bags, and PPE (i.e., gloves, tyvek, boot covers, etc.). Other solids for disposal include waste sediment such as that collected from the core "smear zone" (SOP No. 8) and excess homogenate.

Where practical to do so, solid materials that can be decontaminated including damaged stainless steel or aluminum core tubes, used polybutyrate core liners, and sample bottles, will be decontaminated according to procedures in SOP No. 2, and placed in a DOT 55-gallon drum or bulk bag and stored temporarily until disposal either at a municipal solid waste landfill or hazardous waste disposal facility (i.e., if materials meet disposal facility and regulatory requirements). Other contaminated solid materials which cannot be decontaminated, including plastic sleeve storage bags, aluminum foil, paper towels, and PPE, will be placed in 55-gallon drums or bulk bags and stored temporarily until disposal either at a municipal solid waste landfill or hazardous waste disposal facility (i.e., if materials meet disposal facility and regulatory requirements). All drums and bags containing solids residuals will be labeled and handled as described in Section 5.4 below.

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During processing of the cores, sediment from the smear zone, solids contained in process waste waters, and excess homogenated sediment (i.e., material not sent to the laboratory from a particular sample interval) that can not be placed into a sample bottle and archived will be placed in a 55-gallon drum and stored temporarily until disposal either at a municipal solid waste landfill or hazardous waste disposal facility (i.e., if materials meet disposal facility and regulatory requirements).

5.3 LIQUID WASTES

Waste water will be collected from sediment core processing and decontamination activities. The sediment will be allowed to settle. The water will then be decanted and returned to the Passaic River. Remaining sediment will be disposed in accordance with Section 5.2.2 of this SOP.

Used solvents and acids generated during the decontamination process will be collected and placed in appropriate containers. These containers will be stored temporarily at the 80/120 Lister Avenue properties until recycling or disposal of these liquids at a hazardous waste facility can be arranged.

5.4 HANDLING AND TRACKING OF SOLID MATERIALS CONTAINERS

Waste sediment and other solid waste materials will be placed in DOT tested and approved 55-gallon drums or 30-gallon bags as they are generated during field activities. Solid waste materials which are initially placed in bags may be bulked into 55-gallon drums for storage. The following procedure will be followed for placing sediment and other solid waste in these drums:

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- A drum number will be assigned to each drum by the Site Manager or his designee. The drum number will be marked on two sides of the drum before it is used.
- A log will be kept for each drum, listing the materials placed in that drum. All solid materials will be segregated based on type of material (i.e., sediment, core tubes, core liners, PPE, waste plastic, paper, or foil), and then by where they were generated (e.g., sampling transect, location within transect, etc.).
- All drums will be closed or covered at the end of the day's work.
- Collection drums may be reused at the processing facility after emptying.
- Drums containing solid materials will be stored in a secured temporary facility until proper off-site disposal at the end of all the sampling.

5.5 SAMPLES AND CONTAINERS RETURNED FROM OFF-SITE LABORATORIES

Upon completion of the required geotechnical or chemical analyses, the remaining sample material will be returned to the processing facility. The returned sample material are under chain-of-custody procedures until disposal. Upon receipt of the samples, they will be logged in by designated staff members and the chain-of-custody form signed. The condition of the containers in which the samples are returned will be checked and recorded on the log.

Samples will be separated into sediment and aqueous sample groups. Sediment samples will be removed from the container and placed in a DOT 55-gallon drum until disposal either at a municipal solid waste landfill or hazardous waste disposal facility (i.e., if materials meet disposal facility and regulatory requirements). The sample containers will be decontaminated according to procedures in SOP No. 2, and placed in a DOT 55-gallon drum or bag until disposal either at a municipal solid waste landfill or hazardous

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waste disposal facility (if appropriate). Aqueous samples will be disposed as described in Section 5.3 above with other collected water. Empty sample bottles will be collected, decontaminated according to procedures in SOP No. 2, and placed in a DOT 55-gallon drum or bag until disposal either at a municipal solid waste landfill or hazardous waste disposal facility (if appropriate).

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6.0
DOCUMENTATION

The Site Manager or his designee is responsible for documenting the handling or disposal of all containers filled with solids or liquids generated during the investigation activities. Observations and data will be recorded in ink in a field logbook with consecutively numbered pages. The information in the field logbook will include the following as a minimum:

- Responsible person's name
- Date and time of activity
- Information coordinating container numbers for drums or bags containing solid materials with sample numbers, core boring numbers, or origin
- Information coordinating origin of waste water with specific waste drum or tank

The field logbook will be reviewed and checked for completeness by the Site Manager or the Site Manager's designee.

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STANDARD OPERATING PROCEDURE NO. 8

CORE SAMPLE PROCESSING

Passaic River Study Area

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2.0
TABLE OF CONTENTS

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3.0
PURPOSE AND SCOPE

The purpose of this document is to define the standard operating procedure (SOP) for processing of the sediment core samples collected during the Remedial Investigation in the Passaic River Study Area. The purpose of the core processing is to collect samples for analysis which meet the sample collection and analysis objectives as defined in the Investigation Work Plan (IWP). This procedure is intended to be complete enough that all steps which could affect core processing have been explained in sufficient detail that different field personnel following these procedures will process the core samples in an equally reliable and consistent manner. This procedure gives descriptions of equipment, field procedures, and documentation necessary to initiate core sample processing onboard the sampling vessel and to complete it at the core processing facility.

This plan is to be followed, and any substantive modification to the procedure shall be approved in advance by the CPM, Facility Coordinator, and EPA Project Manager.

The following SOPs will also be utilized during the core sample processing:

- SOP No. 1 - Containers, Preservation, Handling and tracking of Samples for Analysis
- SOP No. 2 - Decontamination
- SOP No. 4 - Sediment Sampling Over Water Using Vibracore
- SOP No. 7 - Management and Disposal of Residuals
- SOP No. 9 - Core Sample Interval Selection Process
- SOP No. 13 - River Stage Measurements and Tidal Corrections

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4.0
RESPONSIBILITIES AND QUALIFICATIONS

The CPM is responsible for assigning Project Staff to process core samples. The CPM is also responsible for assuring that this and other appropriate procedures are followed by Project Staff.

The Project Staff assigned to supervise the processing of core samples are responsible for completing their tasks according to this and other appropriate procedures. Project Staff members are responsible for reporting deviations from the procedure to the CPM, Site Manager or Quality Assurance/Quality Control (QA/QC) Officer.

Only qualified personnel shall be allowed to perform this procedure. Qualifications may be based on previous experience or on-the-job training and supervision by another qualified person.

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5.0
PROCEDURES FOR CORE SAMPLE PROCESSING

5.1 EQUIPMENT LIST

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Since multiple procedures may be contained in the SOP, not all of which are necessarily conducted when using the SOP, not all materials on the Equipment List may be required for a specific activity.

Coring Vessel

- Core extrusion table
- Field logbook and Vibracoring Data Form Packages (3 sets per planned location)
- Tape measure
- Location chart
- Hacksaw and spare blades
- Core caps
- Cooling vests (sheets of iced gel)
- Wrap-around polyethylene "sausage-case" sleeving
- Appropriate personal health and safety equipment
- Appropriate decontamination equipment

Core Processing Laboratory

- Core processing table
- Processing laboratory notebook and associated coring documentation

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- Tape measure
- Location chart
- Hacksaw and spare blades
- Power driver circular saw and spare blades
- Core caps
- Sampling equipment: spatulas and stainless steel bowls
- Refrigerator, at 4EC
- Sample tracking computer equipment
- Appropriate waste disposal equipment
- Appropriate personal health and safety equipment
- Appropriate decontamination equipment

5.2 PROCEDURE

The core processing procedure requires information generated in the office prior to mobilization as well as information generated on the coring vessel at the time the core is collected. To facilitate the accumulation and tracking of this information, a set of Vibracore Data Forms has been developed and appears as Appendix A of this SOP. The forms in Appendix A are designed as inter-active documentation to aid in the decision making process and to collate the relevant data needed for core processing and data interpretation. Relevant data to be recorded on the forms prior to mobilization include the depth of predetermined decade intervals (Form A4) relative to Mean Low Water (MLW) that are taken from Table 3-3 in this FSP and the selection of radiochemistry sample intervals as discussed in Section 3.0 of the FSP, and shown by Table 3-4. Relevant data to be recorded while coring include water depths, tidal measurements and penetration and recovery information for the vibracoring. Since the data from Table 3-3 is combined with data recorded during core collection, calculations are made in the core processing facility to determine sample cuts relative to the top of the core.

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5.2.1 Core Processing on Coring Vessel

1. Calculate sediment surface (equals top of core recovered) relative to MLW in accordance with SOP No. 13, River Stage Measurements and Tidal Corrections. Record water depth corrected to MLW on form A2, item 4c (Corrected Water Depth) calculated by subtracting value recorded as Time and Position Adjusted Height above MLW (Form A2, Item 4b, Column 9) from the measured water depth (Form A2, Item 4a).

2. Also record and plot the Corrected Water Depth as the "present" sediment surface on form A4, Columns 1, 2, 4 and 5.

3. Record and plot base of core penetration on Form A4, Column 4 and 5. If the actual core penetration (Form A2, Item 5, Column 3) is less than 75% of the required penetration (Form A2, Item 5, Column 2) record "No" on Form A2, Item 5, Column 4 and go to Step 7. Otherwise record "Yes" on Form A2, Item 5, Column 4 and proceed to Step 4 below.

4. Visually inspect the recovered core liner. A gap that is evident at the bottom or middle of the core is considered to indicate that some of the penetrated sediments were not recovered and that therefore the bottom (oldest) sediments penetrated are missing from the core. If there is a gap evident in the recovered core at the middle or bottom of the core, or if there is an obstruction evident that would have hindered core recovery, and the core bottom (or the bottom adjusted for the gap in the middle) is above the 1940 depth relative to MLW, then the core recovery is considered inadequate. Skip steps 5 and 6 below and proceed with step 7.

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Calculate the recovery to penetration ratio by dividing recovery (A2, Item 5, Column 5) by required vibracore penetration (A2, Item 5, Column 2) and record in A2, Item 5, Column 6. If core recovery is 0.95 or greater, it is acceptable and record "Yes" in Column 7, and go to step 8. If core recovery is less than 0.75, record "No" and go to SOP No. 8, item 7. If between 0.75 and 0.95, go to Item 5.

5. If the core recovery (recovery/penetration*100) is less than 95% and there are no significant gaps at the top or the bottom, the reduced recovery shall be considered to be caused by either compaction of the sediments as the core barrel proceeds, or to loss of sediment in the core tube owing to some of the sediments being pushed around the outside of the core cutter rather than being collected into the core liner. In both cases, since the cause is related to friction of pushing existing core up through the core liner as the core barrel progresses downward, the loss of sediments is expected to increase with depth. This compaction or loss of sediments compared to the sediment depths in situ will be compensated for through apportionment of the reduced depth across the core with the amount proportional to the depth (increased resistance).

6. The following formula will be used to adjust in situ sediment depths corresponding to each sampling interval boundary to those in the core, compensating for both lack of recovery as evidenced by gaps or obstructions and the compaction/squeezing out of sediments during coring. The accuracy of this assumption will be evaluated after receipt of the radiochemical dating information for a given core through comparison of both the adjusted and unadjusted depths to radiochemical dates and determining whether the adjustment was verified.

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$$\text{Depth(adj)} = \frac{\text{Recovery}}{\text{(Penetration\&Gap)}} \times \text{Depth(exp)}$$

Where:

Depth (adj) is the calculated depth in the sediment core for a given sampling interval boundary adjusted for core recovery.

Recovery is the measured length of core recovered (in feet).

Penetration is the depth of penetration measured by the penetrometer (in feet)

Gap is the measured length of any gap at the bottom or middle of a core (in feet).

Depth (exp) is the given uncorrected sampling interval boundary from Form A4, Column 4.

The calculated, adjusted sampling intervals will be plotted and recorded in Columns 8, 9 and 10 of Form A4. Also plot and record the core bottom position in Columns 8, 9 and 10 of Form A4.

Check penetrometer read out for abnormally high penetration rate. If penetrometer indicates rapid descent, then take samples as if gap in core was not there.

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If the adjusted depth for the 1940 sediment surface is below the bottom of the recovered core, then core recovery is considered inadequate. Record "No" on Form A2, Item 5, Column 7 and proceed to step 7. If the adjusted depth for the 1940 sediment surface is above the bottom of the recovered core, then the core recovery is considered acceptable. If considered acceptable, record "Yes" on Form A2, Item 5, Column 7.

7. If core recovery is found to be inadequate, then cut the core into approximately 5 foot lengths taking care to eliminate any air spaces and cap both ends of the core liner and label sections for archiving.

   Circle "No" on Item i on Form A3 and record information on Form A2 Column 7, and Columns 1 through 5 on Form A3 (comments column on both forms should indicate the core was archived).

   Get new form set for the Location

   Move boat slightly

   Go to Paragraph 5 of SOP No 6 (Section 5.2) for collection of an additional core.

8. Circle "Yes" on Item i, Form A3, with a waterproof pen mark the adjusted decade depths on core liner.

9. Cut core liner at sampling decade depths that are as close to 5 foot lengths as possible. Cap end of cores immediately following cutting.

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10. Measure and mark with waterproof pen the top and bottom ends of each section of core liner and the lengths sequence on each 5' section of core liner. Plot and record these core lengths, the measurements in actual length and the core section bottom and top depths to positive MLW in Columns 11 and 12 of A4.

11. Wrap core liner in cooling vests after wrapping in polyethylene sleeving to protect cooling vests from contamination and store in an upright position.

12. Core sampling crew team leader completes the forms within the Vibracore Data Form Package and signs Form A1 for each Core prior to relinquishing the cores to be transported to the core processing laboratory in an upright position. The relinquished forms accompany the cores to the processing laboratory. Verify that the following items have been completed:

Vibracore Loc. #		
Vibracore Number		Form
Summary of Coring Activities		A1

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Vibracore # Vessel Name Date & Time of Coring Planned Location Accept. Loc. Variance Accept. Pos Variance Post Diff. Position Measured Water Depth River Stage Measurement Table Corrected Water Depth Vibracore Penetration & Recovery Table Comment Section filled with any pertinent information	Form A2
Vibracore Number	Form A3
Vibracore Number All of Table on Form A4 All pertinent information that might effect data quality is filled in	Form A4
Completed only if Geotechnical core taken. Verify Items A through H documentation are in notebooks as well as on form.	Form A5

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13. Transport core in an upright position to core processing laboratory and mobilize to the next sampling location in accordance with SOP No. 4.

5.2.2 Chemical Core Sampling Processing in Core Processing Laboratory for Cohesive Cores

Complete A3 Items a through i, and Columns 3, 4, 5 and 6 from information on Forms A1, A2 and A4.

1. If cores are not processed immediately store vertically at 4EC.

2. Remove top core cap for each core liner, and assess whether core lengths are to be processed as cohesive or non-cohesive sediments. Non-cohesive core sections will be processed as described in Section 5.2.3.

3. Lay out cohesive cores on core processing table.

4. Verify the core log information for the core penetration; core recovery, and water depths corrected to MLW has been entered correctly.

5. Confirm that the decade calculations (Columns 3, 4, 5 and 6) are corrected for percent recovery (% R).

6. Calculate sampling intervals for chemical samples and radiochemical samples in accordance with SOP No. 9, Core Sample Interval Selection. Mark the specified sampling interval ranges observed from Form A5, Column 3 on the outside of the core liner with a waterproof marker.

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7. Using the circular saw adjusted to just greater than the thickness of the core liner, make a longitudinal cut through the core liner.

8. Wedge open the liner using a block to expose the core sediment. Visually describe the core, and record the description in Column 1 of Form A3. For the intervals representing the BAZ, 1980-bottom of BAZ, 1970-1980 and 1940 to 1950 utilize steps 10 through 14 below. See special requirements and procedures in SOP No. 9, Section 5.2.2, paragraph 4, for other sampling intervals.

9. Remove the smear zone of the specified range to be sampled. To remove smear zone, scrape approximately 1/4 inch of exposed sediment and discard in accordance with SOP No. 7, Management and Disposal of Residuals.

10. Immediately after smear zone removal, collect representative volatile sample and fill the pre-labelled sample container minimizing head space, in accordance with SOP No. 1, Container Preservation, Handling and Tracking of Samples for Analysis. Record sample identification, depth, and date on Column 9 on Form A3.

11. Place the upper hemisphere of sediment for the sampling interval in a tared stainless steel bowl. Disturbance to the sediment should be minimized. Weigh bowl and sample after removal of any pebbles, sticks, and leaves and compare to minimum required weight, 400 gms.

12. If there is inadequate sample weight, establish the new interval in accordance with SOP No. 9, Core Sample Interval Selection, Section 5.2.2, Contingency for Inadequate Sample Sizes. Following procedures described

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in Paragraphs 8 and 9 above, remove additional specified sample for the new interval.

13. Thoroughly mix the sample in the center of a decontaminated stainless steel pan or bowl, quarter and mix the individual sample quarters. Roll the entire sample to the center of the pan or bowl for a final mix.

14. Fill pre-labelled sample jars for all remaining chemical analyses, in accordance with SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis. Confirm that the sample identification has been recorded in Column 9, Form A3.

15. Remaining sediment, core lengths and decontamination water related to processing the upper hemisphere of the core will be stored as required or disposed of in accordance with SOP No. 7, Management and Disposal of Residuals.

16. Using Table 3-4 from the FSP calculate sampling interval tops for radiochemical samples and record in Column 10, Form A3. Collect 1-inch thick radiochemistry sample from the lower hemisphere of the core from the sampling intervals specified in Form A3, Column 10 by cutting sediment with a stainless steel spatula. If sample contains sediments from smear zone, remove ¼" outer edge of sample. Record sample numbers and any comments in Column 11 and 12 of Form A3.

17. Discrete samples for radiochemical analysis are placed in pre-labelled 4 oz. jars, in accordance with SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis.

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18. Sediment remaining between radiochemistry samples will be disposed of in accordance with SOP No. 7 - Management and Disposal of Residuals.

19. The sample containers will be labelled and processed according to SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis.

5.2.3 Chemical Core Processing Procedures for Noncohesive Watery Core Samples

For sections of the core that are comprised of high water content sediments, a special 6-inch deep cylindrical collar will be utilized for collecting core sediments. The collar will be designed of either stainless steel or Teflon® and have an outside diameter of approximately **c** inch smaller than the inside diameter of the core liner (i.e., nominally 4 inches). The following protocol shall be implemented for preparing sediment samples with excessive water content:

1. Remove the appropriate core section from cold storage and dry the surface of the core liner with clean paper towels. Place the core section in a vertical core stand with a plastic container beneath the apparatus.

2. Acquire all of the necessary sample containers. Label the sample containers with the appropriate preprinted sample labels.

3. Mark the outside of the core liner in 1 inch increments and also with the sample interval boundaries for both chemical and radiochemical samples, beginning at the top of the core barrel. Note the consistency of sediment material at the depth to be sampled.

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4. While the core section is in a vertical position, the collar will be carefully pushed through the top layer of sediment so as not to disturb the 1/16 inch layer surrounding the inside diameter of the core liner. The collar will have markings on the inside which are spaced 1 inch apart along its length.

5. After the collar is positioned, the appropriate amount of sediment will be scooped out with a stainless steel spatula. Collect a volatile sample and fill the pre-labelled sample container minimizing head space. Remaining material will then be transferred to precleaned pyrex glass or stainless steel mixing bowls for chemical and radiochemical sampling intervals.

6. With the collar still in place, the core liner may be carefully cut around the outside diameter. Repeat steps 4 and 5 until the bottom of a sampling interval is reached. Remove larger objects such as sticks and pebbles. Weigh the sample in the bowls and compare to a minimum required weight of 500g (wet weight). If the sample is less than 500 grams refer to SOP No. 9, Section 5.2.2 for specification of new sampling intervals.

7. Before homogenization, transfer sufficient materials for volatiles analysis to VOA sample containers.

8. Homogenize the sediment material by stirring with a precleaned instrument (either borosilicate glass rod or a teflon spatula or teflon-coated stainless steel) until color and textural differences are no longer detected.

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9. Fill pre-labelled sample jars for both chemical and radiochemical samples, in accordance with SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis.

10. The sample containers will be labelled and processed according to SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis.

11. Remaining sediment, core lengths and decontamination water will be stored as required or disposed of in accordance with SOP No. 7, Management and Disposal of Residuals.

5.2.4 Core Sample Processing in Core Processing Laboratory for Cohesive and Noncohesive Geotechnical Cores

Complete Form A5 for each of the 3 cores at each of the 11 transects shown in Table 3-2 in the FSP.

1. Sampling intervals will be selected at changes in the sediment characteristics based on visual observation of the core lithology obtained during the chemical core processing (Sections 5.2.2 and 5.2.3).

2. Measure on core to approximate locations of lithologic changes.

3. Cut aluminum tube with tube cutter.

4. Cap and label as specified in SOP No. 1 "Containers, Preservation, Handling, and Tracking of Samples for Analysis."

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5. Complete Form A5.

6. Send to geotechnical lab. Quality Assurance/Quality Control Sample requirements are specified in QAPP Section 9.0. Notify geotechnical lab of these requirements.

7. Remaining sediment and core lengths will be stored as required or disposed of in accordance with SOP No. 7, Management and Disposal of Residuals.

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6.0
DOCUMENTATION

The field documentation requirements for the field personnel will include recording pertinent observations made during core sample processing that are pertinent to complete the monitoring and tracking of the samples and that these items could affect the quality of the data. The documentation will be entered in bound field logbooks with consecutively numbered pages.

Documentation should include at a minimum:

- Vibracoring Data Form Packages with appropriate signatures demonstrating handling and relinquishing of the cores.

- Appropriate water depth measurements, bathymetric, and tidal summary data sheets associated with each core.

- Appropriate Chain-of-Custody documentation in accordance with SOP No. 1 - Sample Handling and Documentation for relinquishing samples to analytical laboratories.

- Each entry (or page) in the field and core processing laboratory notebooks should be dated and initialed by the individual(s) making the entry.

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7.0
QUALITY ASSURANCE REQUIREMENTS

Equipment Decontamination

Before any sampling begins, and between processing of each core sample; all small, hand-operated sample collection equipment should be decontaminated in accordance with SOP No. 2.

Field Quality Control (QC) Samples

QC samples will be collected during the coring and core sample processing. QC samples are designed to help identify potential sources of sample contamination and evaluate potential error introduced by sample collection and handling. All QC samples are labeled in accordance with SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis, and sent to the laboratory with the other samples for analysis. QC samples will include rinsate samples, field replicate samples, and matrix spike samples. The QC samples will be collected at the frequency specified in the QAPP.

Rinsate Samples

A decontamination rinsate sample of the sampling equipment is intended to check if decontamination procedures have been effective. For the sediment sampling operation, rinsate samples will be collected at the frequency specified in QAPP Section 9.0. The procedure for collecting rinsate samples is specified in SOP No. 2, Section 6.0. The same parameters that are being analyzed in the sediment samples will be analyzed in the rinsate samples. The rinsate sample is labeled in accordance with SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis, preserved and

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stored in an iced cooler, and shipped to the laboratory with the other samples being analyzed.

Field Replicate Samples

Replicate samples are samples collected side-by-side to check for the natural sample variance and the consistency of field techniques and laboratory analysis. For the coring, replicate samples will be collected at the same time as the initial sample. Replicate samples will be collected at the frequency specified in the QAPP. The replicate samples will be labeled in accordance with SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis, and stored and handled in the same manner as the primary sample.

Matrix Spike Samples

Matrix spikes/matrix spike duplicates (MS/MSD) will be taken for organic analyses and matrix spike/laboratory duplicates (MS/Duplicate) will be taken for inorganic analyses at the frequency specified in the QAPP.

MS/MSD (MS/Duplicate) are used to determine the accuracy and precision of the analytical methods on the site-specific matrix. For this procedure, additional sample volume is collected and the sample designated as the one to be used by the laboratory for the primary analysis and the MS/MSD (MS/Duplicate) analysis. Spiking is performed by the laboratory. The matrix spike samples will be labeled in accordance with SOP No. 1, Containers, Preservation, Handling and Tracking of Samples for Analysis, and stored and handled in the same manner as the primary sample.

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APPENDIX A

VIBRACORE DATA FORM PACKAGE
FORMS A1 through A5

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FORM A1
VIBRACORE SUMMARY DATA FORM

LOCATION _____

VIBRACORE NO. _____

_____

USE

_____

_____

Relinquished By _____ Date _____ Time _____
Relinquished By _____ Date _____ Time _____

Accepted by _____ Date _____ Time _____
Accepted by _____ Date _____ Time _____

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FORM A2
CORE DATA FORM
Sheet 2 of 2

FORM A2
CORE DATA FORM
Sheet 1 of 2

1. VIBRACORE NUMBER _____

2. VESSEL, DATE, TIME INFORMATION

a. Vessel _____
b. Date _____
c. Time of Coring _____

3. POSITIONING DATA

a. Pre-Plot Location _____
b. Acceptable Location Variance _____
c. Acceptable Position Variance _____
d. Recorded Position _____
e. Post Differential Position _____

4. TIDAL CORRECTIONS

a. Measured Water Depth at Time of Coring _____ (nearest 0.1 ft)
b. River Gauge Measurements

1	Pre-Core Reading			Post-Core Reading			8	9
	2	3 Staff Gauge of Tide Recorded Reading	4 Height Above MLW	5	6	7 Height Above MLW	Time Adjusted Height Above MLW	Time and Position Adjusted Height Above MLW
Gauge #	Time			Time	Reading			

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FORM A2
CORE DATA FORM
Sheet 2 of 2

c. Corrected Water Depth _____

5. VIBRACORE PENETRATION & RECOVERY

1 Vibracore #	2 Required Vibracore Penetration	3 Actual Vibracore Penetration	4 Penetration Acceptable	5 Vibracore Recovery	6 Ratio (Recovery/ Penetration)	7 Ratio Acceptable	8 Comments

6. COMMENTS

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FORM A3
CORE LOG

a. **VIBRACORE No.** _____
b. Date of Coring _____
c. Time of Coring _____
d. Corrected Water Depth _____
e. Core Penetration _____
f. Core Recovery _____
g. Recovery/Penetration Ratio ____
h. Penetration Acceptable YES/NO
i. Recovery Acceptable YES/NO

1	2	3	4	Decade Interval Depths Relative to MLW		Chemical Analysis			Radionuclide Analysis		12
				5	6	7	8	9	10	11	
Description	Scale	Decade Interval Depth Relative to Top of Core	Core Length Relative to MLW	Date	Depth	Interval Range	Date Range	Sample No.	Depth	Sample No.	Comments

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FORM A4
VIBRACORE LOCATION BATHYMETRY TABLE
FOR VIBRACORE LOCATION

VIBRACORE # _____ Corrected Water Depth _____
Core Penetration _____
Core Recovery _____
Recovery/Penetration Ratio _____

Predetermined Sediment Surface Relative to MLW (ft)		3 Scale in feet MLW	Vibracore Depth Length Relative to MLW (ft)		6 Decades Related to MLW	7	Decades Adjusted for Recovery/ Penetration Ratio Relative to MLW			Core Lengths Submitted to Processing Laboratory	
1 Digital	2 Plotted		4 Plot	5 Digital Depth			8 Plot	9 Digital Date	10 Digital Depth	11 Depth	12 Length

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